

readable program that includes instructions for implementing a deposition process in accordance with specified limitations. The process implemented by the computer-readable program includes, *inter alia*, a first HDP-CVD deposition, a cooling, an etching, and a second HDP-CVD deposition. The claims limit the types of gaseous mixtures during the steps and limit the deposition/sputter ratio during at least the first HDP-CVD deposition.

The rejections rely primarily on the teachings of Hong, which discloses a PECVD deposition/etching/deposition ("dep/etch/dep") method for depositing a layer in which the etching is performed with a multiple-etch process that includes both a chemical etch and a physical etch (Hong, Col. 2, ll. 24 – 36). This is similar to the prior art discussed by Applicants in the Background of the Invention in their application (Application, p. 2, ll. 16 – 26). The Office Action mailed June 24, 2002 (paper no. 7) (the "Office Action") relies on Hong for its disclosure of a computer-readable storage medium for controlling a deposition process and, in particular, for its disclosure of a dep/etch/dep process (Office Action, p. 2). This teaching is combined with Papasouliotis, which is cited primarily for its disclosure of using a mixture of deposition and inert gases during the deposition portion of the process, and for using a technique during the deposition portion that has both deposition and sputter components (*id.*, p. 3). The Office Action goes on to acknowledge that this cited art does not disclose the step of cooling the substrate, but suggests that it would be obvious to do so in light of the teaching of U.S. Pat. No. 6,015,760 ("Becker").

2. No Prima Facie Case of Obviousness Has Been Established Since No Prior-Art Dep/Etch/Dep Reference Disclosing a Cooling Step Has Been Cited by the Office

The step of cooling the substrate has advantages in the dep/etch/dep process disclosed by Applicants that are not recognized in the cited prior art. Such advantages are disclosed in the specification and include the ability to provide a more controlled etch before the subsequent deposition (Application, p. 20, ll. 5 – 17). It is inherent that this control, when exercised *before* a subsequent deposition, permits better uniformity for that subsequent deposition and therefore permits better gapfill to be achieved.

In responding to the Office Action, Applicants noted, *inter alia*, that the cited prior art fails to disclose or suggest this step of cooling the substrate as required in the claims. In particular, Applicants noted that Becker, rather than teaching that the substrate be cooled actually

teaches *increasing* the temperature of the substrate. In the Advisory Action mailed on September 6, 2002 (paper no. 10) (the "Advisory Action"), the Examiner does not disagree, and responds that Becker was cited "only to provide evidence that the etch rate depended on temperature."

It thus appears that the rejection has no documentary support for a cooling step drawn from the dep/etch/dep art and, therefore, that no *prima facie* case of obviousness has been established. A *prima facie* case of obviousness requires, *inter alia*, that prior-art references teach or suggest *all* of the claim limitations. In particular, the Office Action acknowledges that neither dep/etch/dep reference relied on, i.e. neither Hong nor Papasouliotis, discloses the cooling step, and Applicants' characterization of Becker as teaching an increase in temperature appears to be accepted in the Advisory Action.

If the Examiner is relying on Official Notice as support for the cooling step, such Official Notice is respectfully traversed and Applicants request documentary evidence of such a step (MPEP 2144.03). Such traversal of Official Notice is seasonable since such a basis for asserting that the cooling step was known in the dep/etch/dep art has never been articulated in any Action from the Office. This is particularly the case since the Examiner only most recently indicated in the Advisory Action that Becker was not being relied on to teach the cooling step and has previously acknowledged the lack of such a teaching in the other prior art cited.

3. The Claims Are Allowable Based on the Allowance of Claim 1 of the Parent Application

Applicants additionally note that the Advisory Action does not respond to Applicants argument that the pending claims are allowable based on the allowance of Claim 1 of the parent patent and request that this argument be addressed. This argument is made pursuant to MPEP 2106 and the U.S. Patent and Trademark Office's published Examination Guidelines for Computer-Related Inventions ("EGCRI"). With respect to computer-related inventions, EGCRI §IV.B.2.(a)(i) clarifies that when an apparatus claim encompasses "*any and every* computer implementation of a process, when read in light of the specification, the claim should be examined on the basis of the underlying process" (emphasis in original). That section continues with an example of how to recognize such an apparatus claim. It will:

– define the physical characteristics of a computer or computer component exclusively as functions or steps to be performed on or by a computer, and

– encompass *any and every* product in the state class (e.g., computer, computer-readable memory) configured in *any manner* to perform that process. (*Id.*)

Application of the standard is illustrated in a hypothetical provided in EGCR §IV.B.2.(a)(iii) by describing the subject matter to be recited in the patent specification. Specifically, “[t]he disclosure [should state] ... that it would be a matter of routine skill to select an appropriate conventional computer system and implement the claimed process on that computer system. The disclosure [need] not have specific disclosure that corresponds to the [exemplary] limitations recited in the claim (i.e., no specific software or logic circuit).” Under such circumstances, the “[c]laim encompasses any computer embodiment of process claim [and] patentability stands or falls with process claim” (*id.*).

In the present application, Claims 17 and 20 define physical characteristics of computer components as functions performed by a computer. Except for additionally limiting the deposition/sputter ratio for the second deposition, the steps recited in Claims 17 and 20 are similar to those in allowed Claim 1 of the parent application:

1. A method for depositing a dielectric film on a substrate in a process chamber, the method comprising:
 - (a) providing a first gaseous mixture to the process chamber, the first gaseous mixture comprising a first deposition gas and a first inert gas source;
 - (b) generating a first high-density plasma from the first gaseous mixture to deposit a first portion of the film on the substrate with a first deposition/sputter ratio within the range of 5 – 20, wherein the first deposition/sputter ratio is defined as a ratio of a sum of a first net deposition rate and a first blanket sputtering rate to the first blanket sputtering rate;
 - (c) thereafter, cooling the substrate;
 - (d) thereafter, flowing an etchant gas into the process chamber;
 - (e) thereafter, providing a second gaseous mixture to the process chamber, the second gaseous mixture comprising a second deposition gas and a second inert gas source; and
 - (f) generating a second high-density plasma from the second gaseous mixture to deposit a second portion of the film on the substrate, wherein the step of generating a second high-density plasma is performed with a second deposition/sputter ratio within the range of 5 – 20, wherein the second deposition/sputter ratio is defined as a ratio of a sum of a second net deposition rate and a second blanket sputtering rate to the second blanket sputtering rate.

In addition, the specification does not include specific software, i.e. programming code recited to define the aforementioned functions. Rather, it states that computer code executed by a processor “can be written in any conventional computer-readable programming language” (Application, p. 11, ll. 20 – 21), thus indicating that it would be a matter of routine skill to select an appropriate conventional computer system and implement the claimed process on the computer system. Thus, the computer-readable storage medium defined by Claim 17 and

the system defined by Claim 20 encompass any and every product in the class configured in any manner to perform the process, which is similar to that of issued Claim 1 of the parent. The allowance of that claim, despite the additional limitation on the deposition/sputter ratio of the second deposition, is thus believed also to render Claims 17 and 20 allowable. The dependent claims are patentable by virtue of their dependence from patentable independent claims.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 303-571-4000.

Respectfully submitted,



Patrick M. Boucher
Reg. No. 44,037

TOWNSEND and TOWNSEND and CREW LLP
Tel: 303-571-4000
Fax: 415-576-0300
PMB:pmb
DE 7087380 v1